this is a case study
time: experiments

read: DeGroot & Schervish (2012): $\boxed{DS}$ ch. 1

AMS 131
2 Apr 19

(1)

next time: events, sample spaces, set theory

course web page
ams131-spring19-01.courses.soe.ucsc.edu

webcasts: webcast.ucsc.edu

user: ams-131-1

password: uncertainty-quantification

population
deer at ucsc on 2 Apr 2019

disease?
~~no~~ 0
~~no~~ 0
⋮
~~yes~~ 1
⋮
~~no~~ 0

$N = 800$

mean $\theta = ?$

← quantitative (numerical)

qualitative (categorical)

~~at random~~

sample
the observed deer

disease?
y_1 15
y_2 8
⋮
y_n 05

$n = 113$ ← sample size

mean $\bar{y} = \hat{\theta} = \frac{2}{113}$

$\hat{\theta}$ ← estimate of θ

1 row for each deer

population size

Y

1 row for each individual

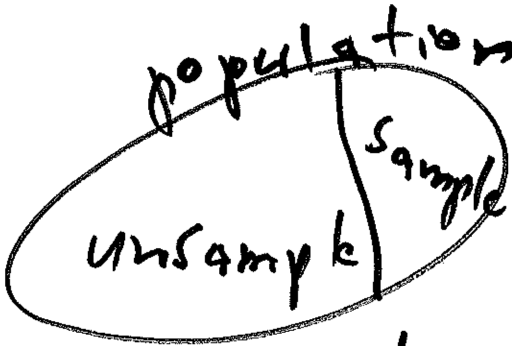
y_1
y_2
⋮
y_n

mean $\bar{y}$ ("y-bar")

1 column for each variable

n

we want our sampling method to be unbiased



goal: make sample & unsample as similar as possible in all relevant ways

simplest method:

choose sampled individuals at random

random sampling doesn't (can't) achieve perfect similarity between sample & unsample every time, but

(A) if we imagine repeating random sampling many (M) times & averaging results, the average will achieve more & more nearly perfect similarity as # of repetitions increases

(B) as sample size (n) ↑, it becomes (3) harder for (sample, unsample) to differ by a lot along relevant dimensions

2 kinds of at-random

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at random with replacement (independent identically-distributed (IID) sampling)

at random without replacement (simple random sampling)

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facts (1) if $n = 1$, IID = SRS

(2) if $n \ll N$, IID $\doteq$ SRS

$\ll$: is a lot smaller than

(3) easier math | more informative

pop

$\begin{bmatrix} 1 \\ 2 \\ 9 \end{bmatrix}$ ∅

at random

sample

$\begin{bmatrix} Y_1 \end{bmatrix}$ $n = 1$

favorable # EO

$$P(Y_1 = 2) = \frac{1}{3}$$

total # EOs

$\boxed{\text{ELM? yes}}$

elemental outcomes (EOS)

(and or not)

$$\begin{pmatrix} \text{1 or} \\ \text{more} \\ \text{T-S} \end{pmatrix} = \begin{pmatrix} \text{exactly} \\ 1 \\ \text{T-S} \end{pmatrix} \text{ or } \begin{pmatrix} \text{exactly} \\ 2 \\ \text{T-S} \end{pmatrix}$$

$$\ldots \text{ or } \begin{pmatrix} \text{exactly} \\ 5 \text{ T-S} \end{pmatrix}$$

$$P(A \text{ or } B) \overset{?}{=} P(A) \;?\; P(B)$$

$$\begin{pmatrix} \text{1 or} \\ \text{more} \\ \text{T-S} \end{pmatrix} = \boxed{\text{not}} \begin{pmatrix} \text{exactly 0} \\ \text{T-S} \end{pmatrix}$$

P(not A) ? P(A)

(exactly 0 T's) = (not T's on 1st) and (not T's on 2nd) and ... and (not T's on 5th)

P(A or B) $\overset{?}{=}$ P(A) ? P(B)
